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***Student Notes***  
***Science on Saturday***  
***Lawrence Livermore National Laboratory***  
***March 11, 2006***

***Diet and Cancer: Are  
Cooked Meats Involved?***

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Goal

Students will learn about methods and limitations found in cancer research, and will explore how scientists at LLNL are investigating the relationship between diet and cancer.

**You will be able to answer the following at the end of this presentation:**

- I. What is a mutation?
- II. What do mutations have to do with cancer?
- III. What is the evidence that cooking produces mutagens?
- IV. How do bacteria tell us anything about cancer in animals or people?
- V. How do scientists decide when a chemical or radiation is a carcinogen?
- VI. How are chemicals from meat purified and measured?
- VII. How does cooking affect carcinogen formation?
- VIII. What are ways to reduce carcinogen formation?

**I. The tough job cells have—reproducing themselves.**

**II. DNA and mutations—the cells instructions.**

**III. Simplifying mixtures—Chromatography.**

**IV. How do bacteria tell us about cancer?**

Ames test, show petri dishes, results.

## **V. What are other mutagenic mixtures to which some people are exposed?**

Cigarette smoke.

Toasted bread products.

Peanut butter.

## **VI. How does cooking affect carcinogen formation?**

Time/temperature/heat flow modeling/meat modeling.

## **VII. How we estimate health effects in people.**

Dose, species, individual susceptibility, compare to other carcinogens, epidemiology studies.

## **VIII. Ways to reduce carcinogen formation.**

Cooking/microwave/marinade/flipping rate.

What should we eat?—the bigger picture.

### **Web sites to find additional information:**

LLNL Biosciences : <http://www.llnl.gov/bio/about/>

LLNL Food Mutagens: [http://www.llnl.gov/bio/groups/food\\_mutagens/](http://www.llnl.gov/bio/groups/food_mutagens/)

### **This lecture supports the following California Content Standards:**

#### **Biology:**

- Students should understand that genes are a set of instructions, encoded in the DNA sequence of each organism that specify the sequence of amino acids in proteins characteristic of that organism.
- Students should have an understanding of the coordinated structures and functions of organ systems that result in the relatively stable internal environment of the human body despite changes in the outside environment.
- Students should have an understanding of the variety of mechanisms organisms have to combat disease.

#### **Chemistry:**

- Students should have an understanding of the bonding characteristics of carbon, which leads to many different molecules with varied sizes, shapes and chemical properties, providing the biochemical basis of life.
- Students should have an understanding of the biological, chemical and physical properties of matter resulting from the ability of atoms to form bonds based on electrostatic forces between electrons and protons, and between atoms and molecules.

#### **Investigation and Experimentation:**

- Scientific progress is made by asking meaningful questions and conducting careful investigations. As a basis for understanding his concept, and to address the content of the other four strands, students should develop their own questions and perform investigations.

**Dr. William Southam, Science Teacher at Castro Valley High School, prepared the Student Notes Worksheet**